model |ˈmädl|
noun
1 a three-dimensional representation of a person or thing or of a proposed structure, typically on a smaller scale than the original *: a model of St. Paul's Cathedral* | [as adj.] *a model airplane.*
• (in sculpture) a figure or object made in clay or wax, to be reproduced in another more durable material.
2 a system or thing used as an example to follow or imitate *: the law became a model for dozens of laws banning nondegradable plastic products* | [as adj.] *a model farm.*
• a simplified description, esp. a mathematical one, of a system or process, to assist calculations and predictions *: a statistical model used for predicting the survival rates of endangered species.*
• (**model of**) a person or thing regarded as an excellent example of a specified quality *: as she grew older, she became a model of self-control* | [as adj.] *he was a model husband and father.*
• (**model for**) an actual person or place on which a specified fictional character or location is based *: the author denied that Marilyn was the model for his tragic heroine.*
3 a person, typically a woman, employed to display clothes by wearing them *: a fashion model.*
• a person employed to pose for an artist, photographer, or sculptor.
4 a particular design or version of a product *: trading your car in for a newer model.*

verb (**-eled** |ˈmɑdld|, **-eling** |ˈmɑdlɪŋ|; Brit. **-elled**, **-elling**) [trans.]
1 fashion or shape (a three-dimensional figure or object) in a malleable material such as clay or wax *: use the icing to model a house.*
• (in drawing or painting) represent so as to appear three-dimensional *: the body of the woman to the right is modeled in softer, riper forms.*
• (**model something on/after**) use (esp. a system or procedure) as an example to follow or imitate *: the research method will be modeled on previous work.*
• (**model oneself on**) take (someone admired or respected) as an example to copy *: he models himself on rock legend Elvis Presley.*
• devise a representation, esp. a mathematical one, of (a phenomenon or system) *: a computer program that can model how smoke behaves.*
2 display (clothes) by wearing them.
• [intrans.] work as a model by displaying clothes or posing for an artist, photographer, or sculptor.

DERIVATIVES
modeler |ˈmädl-ər| |ˈmɑdlər| noun
ORIGIN late 16th cent. (denoting a set of plans of a building): from French ***modelle***, from Italian ***modello***, from an alteration of Latin ***modulus*** (see **modulus**).

THE RIGHT WORD
Most parents try to set a good *example* for their children, although they may end up setting a bad one. An *example*, in other words, is a precedent for imitation, either good or bad.

Most parents would do better to provide a *model* for their children, which refers to a person or thing that is to be followed or imitated because of its excellence in conduct or character. *Model* also connotes a physical shape to be copied closely (*: a ship's model, a model airplane*).
Not all children regard their parents as an *ideal* to which they aspire, a word that suggests an imagined perfection or a standard based upon a set of desirable qualities (*: the ideal gentleman; the ideal of what an artist should be*); but young people's lives often end up following the *pattern* established by their parents, meaning that their lives follow the same basic configuration or design.
While *prototype* and *archetype* are often used interchangeably, they really mean quite different things. An *archetype* is a perfect and unchanging form that existing things or people can approach but never duplicate (*: the archetype of a mother*), while a *prototype* is an early, usually unrefined version of something that later versions reflect but may depart from (*: a prototype for a hydrogen-fueled car*).
Paradigm can refer to an example that serves as a model, but today its use is primarily confined to a grammatical context, where it means a set giving all the various forms of a word, such as the conjugation of a verb.

See also:
http://en.wikipedia.org/wiki/Model :

A mathematical model uses mathematical language to describe a system. Mathematical models are used not only in the natural sciences and engineering disciplines (such as physics, biology, earth science, meteorology, and electrical engineering) but also in the social sciences (such as economics, sociology and political science); physicists, engineers, computer scientists, and economists use mathematical models most extensively.

Eykhoff (1974) defined a mathematical model as 'a representation of the essential aspects of an existing system (or a system to be constructed) which presents knowledge of that system in usable form'.

Mathematical models can take many forms, including but not limited to dynamical systems, statistical models, differential equations, or game theoretic models. These and other types of models can overlap, with a given model involving a variety of abstract structures.

Many mathematical models can be classified in some of the following ways:

1. Linear vs. nonlinear: Mathematical models are usually composed by variables, which are abstractions of quantities of interest in the described systems, and operators that act on these variables, which can be algebraic operators, functions, differential operators, etc. If all the operators in a mathematical model present linearity, the resulting mathematical model is defined as linear. A model is considered to be nonlinear otherwise.

   The question of linearity and nonlinearity is dependent on context, and linear models may have nonlinear expressions in them. For example, in a statistical linear model, it is

assumed that a relationship is linear in the parameters, but it may be nonlinear in the predictor variables. Similarly, a differential equation is said to be linear if it can be written with linear differential operators, but it can still have nonlinear expressions in it. In a mathematical programming model, if the objective functions and constraints are represented entirely by linear equations, then the model is regarded as a linear model. If one or more of the objective functions or constraints are represented with a nonlinear equation, then the model is known as a nonlinear model.

Nonlinearity, even in fairly simple systems, is often associated with phenomena such as chaos and irreversibility. Although there are exceptions, nonlinear systems and models tend to be more difficult to study than linear ones. A common approach to nonlinear problems is linearization, but this can be problematic if one is trying to study aspects such as irreversibility, which are strongly tied to nonlinearity.

2. Deterministic vs. probabilistic (stochastic): A deterministic model is one in which every set of variable states is uniquely determined by parameters in the model and by sets of previous states of these variables. Therefore, deterministic models perform the same way for a given set of initial conditions. Conversely, in a stochastic model, randomness is present, and variable states are not described by unique values, but rather by probability distributions.

3. Static vs. dynamic: A static model does not account for the element of time, while a dynamic model does. Dynamic models typically are represented with difference equations or differential equations.

4. Lumped vs. distributed parameters: If the model is homogeneous (consistent state throughout the entire system) the parameters are lumped. If the model is heterogeneous (varying state within the system), then the parameters are distributed. Distributed parameters are typically represented with partial differential equations.

Mathematics | High School—Modeling

Modeling links classroom mathematics and statistics to everyday life, work, and decision-making. Modeling is the process of choosing and using appropriate mathematics and statistics to analyze empirical situations, to understand them better, and to improve decisions. Quantities and their relationships in physical, economic, public policy, social, and everyday situations can be modeled using mathematical and statistical methods. When making mathematical models, technology is valuable for varying assumptions, exploring consequences, and comparing predictions with data.

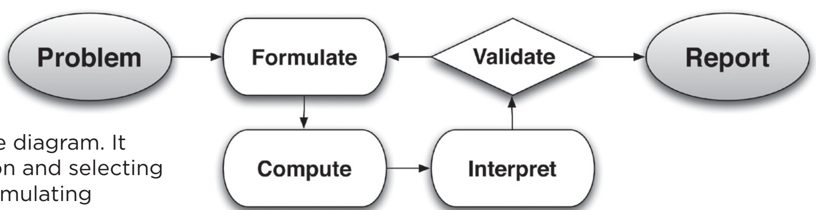
A model can be very simple, such as writing total cost as a product of unit price and number bought, or using a geometric shape to describe a physical object like a coin. Even such simple models involve making choices. It is up to us whether to model a coin as a three-dimensional cylinder, or whether a two-dimensional disk works well enough for our purposes. Other situations—modeling a delivery route, a production schedule, or a comparison of loan amortizations—need more elaborate models that use other tools from the mathematical sciences. Real-world situations are not organized and labeled for analysis; formulating tractable models, representing such models, and analyzing them is appropriately a creative process. Like every such process, this depends on acquired expertise as well as creativity.

Some examples of such situations might include:

- Estimating how much water and food is needed for emergency relief in a devastated city of 3 million people, and how it might be distributed.
- Planning a table tennis tournament for 7 players at a club with 4 tables, where each player plays against each other player.
- Designing the layout of the stalls in a school fair so as to raise as much money as possible.
- Analyzing stopping distance for a car.
- Modeling savings account balance, bacterial colony growth, or investment growth.
- Engaging in critical path analysis, e.g., applied to turnaround of an aircraft at an airport.
- Analyzing risk in situations such as extreme sports, pandemics, and terrorism.
- Relating population statistics to individual predictions.

In situations like these, the models devised depend on a number of factors: How precise an answer do we want or need? What aspects of the situation do we most need to understand, control, or optimize? What resources of time and tools do we have? The range of models that we can create and analyze is also constrained by the limitations of our mathematical, statistical, and technical skills, and our ability to recognize significant variables and relationships among them. Diagrams of various kinds, spreadsheets and other technology, and algebra are powerful tools for understanding and solving problems drawn from different types of real-world situations.

One of the insights provided by mathematical modeling is that essentially the same mathematical or statistical structure can sometimes model seemingly different situations. Models can also shed light on the mathematical structures themselves, for example, as when a model of bacterial growth makes more vivid the explosive growth of the exponential function.



The basic modeling cycle is summarized in the diagram. It involves (1) identifying variables in the situation and selecting those that represent essential features, (2) formulating a model by creating and selecting geometric, graphical, tabular, algebraic, or statistical representations that describe relationships between the variables, (3) analyzing and performing operations on these relationships to draw conclusions, (4) interpreting the results of the mathematics in terms of the original situation, (5) validating the conclusions by comparing them with the situation, and then either improving the model or, if it

is acceptable, (6) reporting on the conclusions and the reasoning behind them. Choices, assumptions, and approximations are present throughout this cycle.

In descriptive modeling, a model simply describes the phenomena or summarizes them in a compact form. Graphs of observations are a familiar descriptive model—for example, graphs of global temperature and atmospheric CO_2 over time.

Analytic modeling seeks to explain data on the basis of deeper theoretical ideas, albeit with parameters that are empirically based; for example, exponential growth of bacterial colonies (until cut-off mechanisms such as pollution or starvation intervene) follows from a constant reproduction rate. Functions are an important tool for analyzing such problems.

Graphing utilities, spreadsheets, computer algebra systems, and dynamic geometry software are powerful tools that can be used to model purely mathematical phenomena (e.g., the behavior of polynomials) as well as physical phenomena.

Modeling Standards *Modeling is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol* (★).